

**A BRIEF REPORT ON
SCIENCE ACADEMIES LECTURE WORKSHOP
ON
“DIFFERENTIAL EQUATION AND MATHEMATICAL MODELLING”
27th- 29th SEPTEMBER, 2017**

The three day lecture workshop on “**Differential Equations and Mathematical Modelling**” sponsored by the Science Academies’ (for undergraduates) was successfully organized by the Coordinator Ms. Laxmi, Assistant Professor, Lakshmibai College under the guidance of the Convener Prof. Ajit Iqbal Singh, Emeritus Scientist, INSA at Lakshmibai College, University of Delhi during 27th-29th September,2017.

The objective of the workshop was to attract undergraduates to study and to pursue research in the area of Differential Equations and Mathematical Modelling . The progress and developments in Differential Equations and Mathematical Modelling are deeply intertwined and their advancements are fully complimentary. Hence a platform to discuss these topics together will be academically enriching. This Workshop will provide a right setting, wherein exciting and interactive discussions among undergraduates, research scholars and distinguished speakers will take place to enhance the knowledge of the subject and their applications to the real world.

The registration of 79 candidates (including 38 students from our college) including 12 faculty members of Department of Mathematics , Lakshmibai College and other colleges was done at 8:30 am near Library Lawn outside Lecture Theatre-I to participate in the Science Academies’ lecture workshop on Differential Equations and Mathematical Modelling . The registration materials (Folder, note pad, pen and badges) including a detailed schedule of the workshop were provided to the participants.

INAUGURAL SESSION: - 9:00 am – 9:30 am

The inaugural function of the workshop took place at 9:00 a.m. on the first day. The lighting of camp was done by invited speakers, convener and coordinator of the workshop which was followed by Saraswati Vandana. The welcome address and brief introduction of the invited speakers was given by student Ms Shruti (BSc Maths Hons IIIrd year)(an Anchor of the workshop) followed by screening of PPT which gave a brief introduction of the three Academies’ of our country (Indian Academy of Sciences- Bangalore, Indian National Science Academy- New Delhi and The National Academy of Sciences, India- Allahabad ,Science Education Panel and various programmes included in Science Education Programme. The coordinator Ms. Laxmi highlighted the importance of Differential Equation, Mathematical Modelling and its applications. She also extend her warm welcome to distinguished speakers, Convener, Principal, colleagues, participants and the student volunteers for taking a keen part in this workshop .She also gave special thanks to Convener Prof. Ajit Iqbal Singh for her kind support, suggestions and guidance given, as and when required .She also expressed her gratitude to the Science Academies’ for extending support in organizing this workshop. The

workshop was held in Lecture Theatre-I (LT-I). The three day workshop was divided broadly into four sessions per day. Keeping in mind the importance of time the first session started exactly at 9:30 am followed by high tea at 11:00 am.

SESSION 1:- 9:30 am - 11:00 am

The speaker Prof. A.K Nandakumaran delivered the lecture on “**STABILITY ANALYSIS-I**” through power point presentation. The lecture included the Introduction and discussing Physical Models (Population Model, Atomic Waste Disposal Model, Spring Mass Dashpot problem, RLC Circuit) for giving the idea of Stability theory. He also recommended the book “**ORDINARY DIFFERENTIAL EQUATION**” and online video courses.

SESSION 2 :- 11:30 am - 1:00

The speaker Prof.V.D.Sharma delivered lecture on “**Classification and Methods of Solving Partial Differential Equation**”. He discussed the classification of Partial Differential Equations by giving the examples of linear, non-linear, Quasi-linear and Semi linear equation and also discussed the method of Characteristics to find the solution of Cauchy’s Data Problems and well posed problems through examples. He also motivated the students to analyze the solutions.

SESSION 3:- 2:00 pm - 3:30 pm

The speaker Prof. A.K Nandakumaran delivered his second lecture on “**STABILITY ANALYSIS-II**”. The lecture included the Introduction of Matrix algebra by giving the definition of Exponential of a matrix and Computation, Phase Plane and Phase Portrait, Stability of 2x2 Systems. Introducing a new variable into the nth order linear system of Ordinary Differential Equations. A first order system of an equation which is further converted into matrix representation which helps us to find the solution. The main focus of this talk was to study the stability of 2x2 systems matrix via diagram and to bring about the role of algebra.

SESSION 4:- 4:00 pm - 5:15 pm

Parallel interactive/tutorial sessions were taken by Prof. V. D. Sharma and Prof. A. K. Nandakumaran with groups G2 and G4 in LT-I and with the groups G1 and G3 in LT-II respectively.

28.9.2017 Day 2

The workshop started with same enthusiasm among the students and teachers.

SESSION 5:- 9:00 am - 10:30 am

The speaker Prof. A. K. Nandakumaran delivered the lecture on “**Mathematical Modelling of Tomography**”. The lecture included the introduction of Tomography, X-Ray Tomography, X-Ray and radon Transforms Ray Tomography: Imaging a refractive index distribution and optical tomography. He explained us about the applications of Tomography in X-ray, CT Scan, MRI (magnetic resonance imaging), Ultrasound, Single photon emission, Optical, electron, Doppler, Radar, Sonar, microwave and in quantum Tomography etc. He also gave illustrations for better understanding.

SESSION 6:- 11:00 am - 12:30pm

Prof. Subhendu Ghosh gave the lecture on **“Application of Differential Equations in Brain Science- I”**. He told us about the role of neurons and their mechanism in a human body with the help of the videos. He also emphasized the importance of Mathematics specially the Differential Equations in Biophysics by briefing that the neurons mechanism can be modelled as a set of differential equations which can further solved for better understanding of the neurons mechanism.

SESSION 7:- 1:30 pm - 3:00 pm

Parallel interactive/tutorial/practical sessions were taken by Prof. V. D. Sharma, Prof. A. K. Nandkumaran and Prof. Subhendu Ghosh with the group G3 in LT-II, with the groups G2 and G4 in LT-I and with the group G1 in Computer Lab-I (CL-I) respectively. Practical Sessions were assisted by two of the (Research Scholars) students of Prof. Subhendu Ghosh started by giving the basic introduction of programming in Matlab combined with the programming approach of solving differential equations. They demonstrated the classical Hodgkin Huxley (HH) model for Action Potential, numerically investigated the effect of inputs and initial conditions on the dynamics of action potentials.

SESSION 8:- 3:15 pm - 4:45 pm

The speaker Prof. V. D. Sharma gave the lecture on **“Conservation Laws and Burger’s Equation”**. He told us about its utility in daily life by various examples. He mainly emphasized the analysis of solutions of PDE and discuss some problems with weak solutions after giving the idea of weak solutions.

29.9.2017 DAY 3

SESSION 9:- 9:00 am - 10:30 am

The speaker Prof. V. D. Sharma gave the lecture on **“Riemann Problem”**. The zeal among the students and teachers was appreciable. Continuing the weak solutions of Riemann problem, he discussed some easy ways to fill the discontinuous part of the solutions to make the solutions well posed in a very interesting manner.

SESSION 10:- 11:00 am - 12:30 pm

The speaker Prof. Subhendu Ghosh started the lecture on **“Application of Differential Equations in Brain Science- II”** by showing some video again. He threw some light on the functioning of neurons which can further modelled as Hodgkin Huxley (HH) equation (Nonlinear Diffusion Equation) for Action Potential.

SESSION 11:- 1:30 pm - 3:00 pm

Parallel interactive/tutorial/practical sessions were taken by Prof. V. D. Sharma and Prof. Subhendu Ghosh with the group G1 in LT-I and with the groups G2, G3 and G4 in

Computer Lab-I (CL-I) respectively. In practical sessions, same concepts were repeated with different group of students.

SESSION 12:- 3:15 pm - 4:45 pm

Prof. Subhendu Ghosh gave his last lecture on **“Application of Differential Equations in Brain Science-III”** in which a PPT was shown, highly informative explaining the simulation given to neurons are related to perturbation in the solutions of differential equations which further raises the concept of stability among the neurons and the Action Potential in Hodgkin Huxley (HH) equation needed to be study.Although the biology of the whole process of Learning & Memory is very complex but the purpose of the talk was to show how differential equations helps understanding the process depending on the functioning of neurons.

Feedback Session and Valedictory session : 4:45 pm – 5:15 pm

The participants and the faculty of Department of Mathematics, Lakshmbai College expressed their views and the fruitfulness of the workshop extending their thanks to coordinator and convener for organizing this workshop.

The convener Prof. Ajit Iqbal Singh sang her mathematics based poem to motivate students and congratulated the whole team of Mrs.Laxmi for such well-organized workshop.Mrs.Laxmi extended her thanks to everyone the part of the workshop and the invited speakers for taking out their valuable time to deliver the talk and enriching our students with their knowledge and wisdom.She again thanks to Science Academies’ for funding these kind of workshop to benefit the local students under the initiatives of Science And Society.

Glimpses of Workshop



